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**GENDER DIFFERENCES IN THE ASSOCIATION OF LIFE STYLE  
FACTORS TO THE PREVALENCE AND SYMPTOMS OF MIGRAINES  
AND OTHER HEADACHES AMONG NAVY PERSONNEL**

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## Summary

*Background.* Migraine is a serious and painful disorder characterized by severe headaches that often are associated with sensitivity to light and noise, visual disturbances, and nausea. Previous studies have reported that migraines are more common in women than men, and that peak onset is at ages 25-55 years. Few previous studies have examined the association between life-style characteristics and prevalence of migraines and their symptoms.

*Methods.* A cross-sectional study questionnaire-based survey was performed of 2,914 women crew members and a matched comparison group of 2,841 men assigned aboard 36 U.S. Navy ships during 1994-1996. The men were matched to the women on ship, work division, department, race, pay grade group, rating, and date of birth  $\pm$  2 years).

*Results.* The overall median ship response rate for the 36 ships was 63.1% and the overall mean response rate was 52.2%. The overall median response rate for women was 66.2%. Age of respondents was 18-51 years, with a mean of 26 years. Approximately 60% were white, 30% black, and 10% other racial groups; 5% of the respondents were officers. Approximately 60% of women and half the men reported experiencing a headache during the past 30 days (prevalence rate ratio for women compared to men = 1.4, 95% confidence interval (CI) = 1.3-1.4). A total of 36% of women and 19% of men had headaches with symptoms associated with migraine (rate ratio = 1.9, 95% CI 2.1-2.7). A history of doctor-diagnosed migraines was reported by 13% of women and 6% of men (rate ratio = 2.1, 95% CI 1.8-2.5). There was no association of migraine with age in either gender. Significantly more enlisted women in pay grades E5-E9 had migraines than women in lower pay grades. In a multiple logistic regression analysis with adjustment for age, race, and pay grade, odds ratios for women compared to men were 1.5 (95% CI 1.4-1.6) for headaches, 1.5 (95% CI 1.4-1.6) for migraine symptoms, and 1.6 (95% CI 1.4-1.7) for history of diagnosed migraines. Sensitivity to light was the most common migraine symptom, and it occurred more often in women than men. Cigarette smoking was positively associated with migraines in both genders. There was no consistent association of headaches or migraines with usual alcohol intake, exercise, or obesity. Sleeping seven or more hours per 24-hour interval was significantly associated with fewer reported symptoms of possible migraines in both men and women.

*Conclusions.* Consistent with previous reports in the general population, women in the shipboard population were significantly more likely than men to report headaches, headaches with migraine symptoms, and a history of diagnosed migraines. The positive association of migraines with cigarette smoking suggests that prevalence rates might be reduced by limitation of exposure to smoking. The association with hours of sleep suggests that sleeping seven or more hours per night may be associated with reduced prevalence of migraines, although the time sequence could not be established with certainty since the study was cross-sectional. Further research on the association of hours of sleep with migraines is needed, since hours of sleep aboard ship are often limited.

## **Introduction**

There are numerous reports indicating that women use medical care and seek help from health care providers more often than men [1-4]. Women have also been found to report more symptomatology and higher morbidity than men [3-8]. However, there are relatively few large, population-based comparisons of the experience of symptoms and health conditions of relatively young men and women. There are also very few studies with sample sizes large enough to describe variation according to racial or ethnic group. Data from the National Health Interview Survey suggest there may be substantial variations [9].

Several studies have noted that women report more migraine headaches than men (15-18% compared to approximately 6%), and that migraines occur most frequently between the ages of 25 and 55 years [10, 11]. One population-based study in Finland reported that among women 54% of all headaches were migraines, compared to 39% among men [12]. In the United States, women from lower-income households were at higher risk of having migraines, and were more likely to use health care services for their headaches even after adjusting for headache severity [4, 13]. Relatively few studies have examined the association of life style characteristics with migraines and other headaches. One cross-sectional survey found no significant association between tension or migraine headaches and smoking, coffee or alcohol consumption, but a significant association between tension headaches and lack of physical exercise [14]. Both tension and migraine headaches were associated with sleeping problems [14].

The present study will examine the association of obesity, cigarette smoking, alcohol consumption, exercise, and hours of sleep with the prevalence of migraines and other headaches among a large population-based sample of men and women in the Navy.

## **Methods**

This study was conducted as part of the Women Aboard Navy Ships Comprehensive Health and Readiness Research Project at the Naval Health Research Center in San Diego, California as part of the Defense Women's Health Research Program, supported by the U.S. Army Medical Research and Materiel Command and the Naval Medical Research and Development Command. This epidemiologic research project utilizes several data collection methods including surveys administered aboard ship. The project is a multi-year effort with all women serving aboard ship eligible for inclusion, along with an equal number of men matched on important characteristics. This is a report of based on the first 11 months of data collection.

## **Population**

All women serving aboard U.S. Navy ships were eligible for inclusion in the survey portion of the study. An equal number of men serving aboard ship matched on relevant characteristics also were eligible. The Navy Bureau of Personnel (PERS-00W) provided a listing of all ships with women assigned aboard; this listing was verified with respective Fleet Surgeons and Force Medical Officers. A total of 74 ships with 7,944 women and 69,012 men assigned were determined to be eligible for inclusion in the study.

This report is based on the first 36 ships surveyed. These ships were surveyed based on availability as determined by the Commanding Officer and Medical Department of each ship. The ships surveyed included USS BARRY (DDG53), USS CAMDEN (AOE2), USS CAPE COD (AD43), USS CIMARRON (AO177), USS COMSTOCK (LSD45), USS CORONADO (AGF11), USS CURTIS WILBUR (DDG654), USS DETROIT (AOE4), USS DIXON (AS37), USS EMORY S. LAND (AS39), USS FRANK CABLE (AS40), USS GRAPPLE (ARS53), USS GRASP (ARS51), USS HOLLAND (AS32), USS JOHN YOUNG (DD973), USS KISKA (AE35), USS LASALLE (AGF3), USS L.Y. SPEAR (AS36), USS MCKEE (AS41), USS MONONGAHELA (AO178), USS MOUNT BAKER (AE34), USS MOUNT HOOD (AE29), USS MOUNT WHITNEY (LCC 20), USS PLATTE (AO186), USS MOUNT RAINIER (AOE7), USS RUSHMORE (LSD47), USS SACRAMENTO (AOE1), USS SAFEGUARD (ARS50), USS SALVOR (ARS52), USS SANTA BARBARA (AE28), USS SHASTA (AE33), USS SHENANDOAH (AD44), USS SIMON LAKE (AS33), USS SUPPLY (AOE6), USS WILLAMETTE (AO180), and USS YELLOWSTONE (AD41). These 36 ships had 5,510 women and 18,443 men assigned aboard.

## **Matching**

The men aboard ship included in this study were matched to women on the following characteristics: ship, work division, department, race (white, black, Hispanic, and other), pay grade (E1-E3, E4-E6, E7-E9, O1-O3, O4-O6), rating (if no individual was available in the same rating, an individual with a closely related rating was selected), and date of birth (nearest date of birth, not to exceed plus or minus two years). In the infrequent instances where these criteria could not be met, men who matched as closely as possible to women were selected.

The procedure for selection of the matched men in the study was as follows:

(1) the eligible population was determined using NHRC files, and an electronic roster was developed which included all data elements needed for matching; (2) the personnel department of each ship provided an electronic roster with limited information which was compared to the NHRC roster, and a final roster was determined; (3) a matching program was run to select the men to be included in the survey; and (4) individual identification labels were created and affixed to survey packets.

## **Survey Development**

Several methods were used for the development of the U.S. Navy Shipboard Health Survey used in this study, including the following: (1) review of extant questionnaires, literature, and standard scales, (2) convening of a panel of subject matter experts, (3) elicitation of major issues from knowledgeable sources, and (4) review of Navy requirements concerning the reporting of women's health and access to health care.

A series of questionnaires developed by the Centers for Disease Control and Prevention (CDC), Department of Defense, U.S. Navy, U.S. Army, and several universities [15, 16] were reviewed and adopted for use in this study. The questionnaires developed by the CDC included the National Health Interview Survey [17], the Health Interview Survey Form HIS-1(1992) and HIS-2(1992) [18, 19], the National Ambulatory Health Care Survey for 1994, 1995, and 1996 [20], and the Youth Behavior Survey [21]. Previous questionnaires developed by the Naval Health Research Center also were reviewed, and ranged from nutrition surveys to patient care surveys. In addition, a series of scales and inventories were reviewed and selected for use. These standard scales included but were not limited to: Center for Epidemiological Studies Depression Scale (CES-D) [22], a scale which measures the current frequency of depressive symptoms, and the Quality of Life Scale [23], a four-item scale previously used in research on Navy populations.

## **Survey Administration**

The overall administration plan included the distribution of individually identified packets with all necessary materials to each study subject. Whenever possible, study subjects were brought together in a common location aboard ship, briefed on the study, asked to sign informed consent and to complete the survey while study coordinators were present. When, due to shipboard activity, it was not practical for all study subjects to remain in one area, surveys were distributed, and the participants were allowed to fill them out in work spaces. The completed surveys were collected by study staff in sealed envelopes in all cases.

## **Response Rates**

The overall median ship response rate for the 36 ships was 63.1%, and the overall mean response rate was 52.2%. The overall median response rate for women was 66.2%. Participation rates varied by the number of women serving aboard ship. Ships with fewer than 100 women assigned had an overall median response rate for women of 69.5% compared to ships with more than 100 women assigned, which had an overall median response rate for women of 49.9%.

## **Variables**

The Navy questionnaire included questions on the experience of any headache (migraine or nonmigraine) and headache symptoms during the past 30 days. These symptoms included several major components of the International Headache Society diagnostic criteria for migraines

(visual disturbances, sensitivity to noise, sensitivity to light and nausea). Experience of any migraine symptom was calculated by combining responses to each symptom. The questionnaire also included an item ascertaining prior physician diagnosis of migraine.

The questionnaire also included information on many life style characteristics, which were coded in the following ways. Those who had not smoked at least 100 cigarettes in their entire life and reported either not smoking any cigarettes or less than 1 cigarette per day in the past 30 days were considered as nonsmokers. Women who reported smoking 1 or more cigarettes per day were considered as current smokers. Nondrinkers were those who reported not having any alcoholic beverages in the past 7 days, while those who reported drinking on 1 day were considered as light drinkers, on 2-4 days moderate drinkers, and on 5-7 days heavy drinkers. The number of drinks consumed in the past week was calculated by multiplying the frequency of alcohol consumption(days/week) by the average number of drinks per day. Those who reported not engaging in exercise or exercising only once or twice per week were considered as light exercisers, while those who engaged in exercise 3-4 times per week were considered moderate exercisers, and those who engaged in exercise 5 or more times per week were considered heavy exercisers. Body mass index defined as  $\text{weight (kg)}/\text{height(m)}^2$  was used as an estimate of obesity. Sleeping pattern was categorized as four hours or less, five to six hours, and seven or more hours.

### **Statistical analyses**

Descriptive statistics were calculated for age, race, pay grade, each life style variable, each symptom, and any headache and migraine diagnosis. Chi-square analyses were used to calculate the proportion reporting headaches, symptoms or migraine diagnosis by quartile of body mass index, current cigarette smoking (no/yes) alcohol frequency (none/low/moderate/high), and exercise (none or low/moderate/high). Separate logistic regression analyses were used to examine the risk of each symptom by age, race and pay grade, and by each life style factor after adjustment for age, race and pay grade. All statistical tests were two-tailed.

### **Results**

There were 2,841 men and 2,912 women who completed the survey. Age ranged from 18-51 years in men and 18-49 years in women, with a mean age of 26.4 and 26.0 years respectively. Of these personnel, approximately 60% were white, 30% black and 10% were of other racial groups (Table 1). Slightly more women than men were employed at the lower pay grades, 62% versus 56% were at enlisted levels E1-E4. Forty percent of men and 33% of women were at enlisted levels E5-E9. The proportion of officers was roughly similar, with 4.4% of men and 5.0% of women reporting officer status. The distributions of each of the life style variables are also presented in Table 1. Men reported more cigarette smoking, greater alcohol consumption, and more regular exercise than women. Men were also more likely to report getting 7 or more hours of sleep.

Table 1. Distribution of demographics and life style characteristics, U.S. Navy Women Aboard Ship Study, 15 NOV 1994 - 31 DEC 1996.

	Men			Women		
	N	Mean	SD*	N	Mean	SD
Age in years	2,841	26.4	6.3	2,912	26.0	6.1
Body Mass Index (BMI)	2,691	25.3	3.3	2,740	23.6	3.1
		<u>Percent</u>			<u>Percent</u>	
Race	2,841			2,907		
White		60.4			58.2	
Black		28.8			31.8	
Other		10.8			10.0	
Pay grade	2,840			2,912		
Enlisted E1-E4		56.0			61.7	
Enlisted E5-E9		39.6			33.3	
Officer		4.4			5.0	
Current smoking	2,726			2,822		
No		61.8			65.5	
Yes		38.2			34.5	
Alcohol frequency (drinks/weeks)	2,719			2,782		
None		39.2			50.9	
1		16.9			19.1	
2-4		32.4			25.2	
5-7		11.5			4.7	
Exercise frequency	840			846		
≤2x/week		18.8			24.6	
3-4x/week		44.8			44.9	
≥5x/week		36.4			30.5	
Sleep (hours/24-hour period)	808			831		
1-4		11.8			13.2	
5-6		58.7			61.5	
≥7		29.6			25.3	

\*SD, standard deviation

Table 2 presents prevalence rates and rate ratios for headaches, headaches with migraine symptoms, and diagnosed migraines by gender. Women uniformly reported headaches, migraine symptoms, and doctor-diagnosed migraines more often than men. Among the possible symptoms of migraine, sensitivity to noise and light were reported most frequently, by 15% of the men and 22-25% of the women. After age-adjustment, nearly twice as many women as men reported headaches with visual disturbances, while three times as many women reported headaches accompanied by nausea.

Table 2. Prevalence rates and rate ratios for headaches, diagnosed migraines and possible migraine symptoms associated with reported headaches, U.S. Navy Women Aboard Ship Study, 15 NOV 1994 - 31 DEC 1996.

	Men Percent	Women Percent	Rate Ratio	95% Confidence interval
<b>Headaches</b>				
Any headaches	41.5	58.5	1.4*	1.3-1.5
Headaches with symptoms	19.0	35.5	1.9*	2.1-2.7
Doctor-diagnosed migraines	6.2	13.2	2.1*	1.8-2.5
<b>Migraine symptoms associated with headaches</b>				
Visual disturbance	6.9	12.7	1.8*	1.5-2.2
Sensitivity to noise	14.6	21.8	1.5*	1.3-1.7
Sensitivity to light	14.6	25.4	1.7*	1.5-2.0
Nausea	7.6	23.2	3.1*	2.6-3.6

\* $p < 0.001$  based on chi-square statistic

The association of demographic characteristics and headaches, migraine symptoms, and diagnosed migraines is presented in Table 3. There was no association with age for either sex. The rate of migraine symptoms was significantly lower in black men and women than in whites. In addition, the prevalence rate of any headaches was significantly lower in black women than in white women. Enlisted men in pay grades E5-E9 had significantly higher rate of headaches and migraine symptoms than enlisted men at lower pay grades (E1-E4), while significantly fewer male officers reported headaches and migraine symptoms. Similarly, the rate of migraine symptoms was significantly lower in female officers than in enlisted women at ranks E1-E4. However, significantly more enlisted women at ranks E5-E9 reported diagnosed migraines, compared to enlisted women at lower ranks (E1-E4). In a combined model adjusted for age, race, and pay grade (data not shown), women were more likely than men to report headaches (OR=1.5, CI=1.4-1.6,  $p < 0.001$ ), migraine symptoms (OR=1.5, CI=1.4-1.6,  $p < 0.001$ ), and diagnosed migraines (OR=1.6, CI=1.4-1.7,  $p < 0.001$ ).

Table 3. Multiple-adjusted association of life style characteristics and headaches, possible migraine symptoms, and diagnosed migraines, U.S. Navy Women Aboard Ship Study, 15 NOV 1994 - 31 DEC 1996.

	Men						Women					
	Headaches			Symptoms			Headaches			Symptoms		
	OR	95% CI		OR	95% CI		OR	95% CI		OR	95% CI	
Age (per year)	.99	(.98-1.02)		.98	(.95-1.01)		.99	(.97-1.01)		.99	(.97-1.01)	
Race												
White	1.0			1.0			1.0			1.0		
Black	.91	(.80-1.03)		.81 <sup>†</sup>	(.67-.96)		.87 <sup>†</sup>	(.77-.99)		.82 <sup>†</sup>	(.71-.94)	
Other	.96	(.81-1.13)		.93	(.75-1.16)		.86	(.72-1.02)		.90	(.74-1.08)	
Paygrade												
Enlisted E1-E4	1.0			1.0			1.0			1.0		
Enlisted E5-E9	1.46 <sup>‡</sup>	(1.23-1.73)		1.40 <sup>†</sup>	(1.07-1.82)		1.08	(.90-1.30)		1.10	(.91-1.33)	
Officer	.63 <sup>‡</sup>	(.48-.82)		.50 <sup>†</sup>	(.16-.78)		.91	(.71-1.17)		.67 <sup>†</sup>	(.51-.88)	
Body Mass Index quartile												
I (lowest)	1.0			1.0			1.0			1.0		
II	.94	(.81-1.08)		1.03	(.86-1.22)		.97	(.85-1.13)		.98	(.85-1.10)	
III	.98	(.86-1.12)		.94	(.79-1.11)		.99	(.86-1.15)		1.13	(.98-1.30)	
IV (highest)	1.06	(.94-1.22)		1.04	(.88-1.23)		1.05	(.91-1.22)		1.09	(.95-1.26)	
Current Smoking												
No	1.0			1.0			1.0			1.0		
Yes	1.09 <sup>†</sup>	(1.01-1.19)		1.11 <sup>†</sup>	(1.01-1.23)		1.08	(.98-1.18)		1.14 <sup>†</sup>	(1.05-1.23)	
Alcohol frequency (drinks/week)												
0	1.0			1.0			1.0			1.0		
1	1.11	(.95-1.30)		1.02	(.84-1.25)		1.28 <sup>†</sup>	(1.06-1.55)		1.12	(.94-1.32)	
2-4	.97	(.85-1.10)		1.00	(.85-1.17)		.83 <sup>†</sup>	(.70-.98)		1.04	(.88-1.22)	
5-7	1.04	(.89-1.25)		1.09	(.87-1.37)		1.12	(.82-1.52)		.89	(.67-1.19)	
Exercise frequency (times/week)												
<2	1.0			1.0			1.0			1.0		
3-4	1.15	(.95-1.40)		1.22	(.93-1.60)		.90	(.73-1.10)		1.01	(.84-1.24)	
≥5	.98	(.80-1.19)		.99	(.75-1.32)		1.18	(.94-1.49)		1.15	(.93-1.42)	
Hours sleep (hours/24 hour period)												
4	1.0			1.0			1.0			1.0		
5-6	.99	(.81-1.22)		1.02	(.78-1.33)		1.03	(.83-1.29)		1.16	(.95-1.42)	
≥7	.90	(.72-1.14)		.72 <sup>†</sup>	(.52-.99)		.78	(.60-1.01)		.58 <sup>‡</sup>	(.45-.75)	

Multiple logistic regression adjusted for age, race, and paygrade.

CI=confidence interval

<sup>†</sup>p<0.05, <sup>‡</sup>p<0.01, <sup>‡</sup>p<0.001

The association of each lifestyle variable with headaches, headaches accompanied by possible migraine symptoms, and diagnosed migraines is also presented in Table 3, after adjustment for possible differences in age, race and paygrade. Of note, cigarette smoking was significantly associated with the experience of headaches, symptoms, and migraine diagnosis for both men and women, while the report of seven or more hours sleep was significantly associated with fewer reported symptoms of possible migraines for both men and women, and significantly fewer diagnosed migraines among women. No consistent associations were observed between headaches and alcohol consumption, exercise or obesity.

### **Discussion and Conclusions**

Consistent with existing reports [4, 10, 11, 13], women were significantly more likely to report headaches, headaches accompanied by migraine symptoms, and diagnosed migraines than men. Among the possible migraine symptoms, sensitivity to noise and light were the most frequently reported by both sexes, however they were reported almost twice as often by women.

Results of the present study indicate that cigarette smoking was significantly associated with higher prevalence of headaches, headaches accompanied by migraine symptoms, and diagnosed migraines among both men and women. In contrast, both men and women reporting seven or more hours sleep were significantly less likely to report migraine symptoms. Of note, there was little if any association between headaches and alcohol consumption, exercise or obesity. While the prevalence of headaches, symptoms and diagnosed migraines were more common among women than men in this study, the presence or absence of an association between lifestyle variables and headaches did not differ substantially between men and women.

These findings are consistent with a cross-sectional study of headaches from Denmark [14] and other countries [24-27], in that no association was found with alcohol consumption. In contrast to previous studies [14, 24-27], the present study found a strong association between cigarette smoking and headaches, headaches accompanied by migraine symptoms, and diagnosed migraines.

The present study found no association between reported exercise and headaches or symptoms, while the Denmark study found a significant association between reported lack of physical activity and tension headaches [14]. That study [14] also found an association between tension and migraine headaches and sleeping problems, but not length of sleep. Similar to the present study, two other studies found a higher prevalence of reported headaches among those sleeping fewer hours per day [27-28].

The foregoing discrepancies between studies may reflect differences in the measurement of lifestyle factors or headaches, in the length of time since onset of headaches, geographic differences, or differences between a general population-based sample and a military population. The latter tends to be healthier, and has several enforced behavioral factors (such as quantity of exercise and duration of sleep). Length of time since onset of headaches can be important in a cross-sectional study, if the lifestyle variable is a trigger factor for migraines or other headaches.

Individuals may change their behavior to avoid a known trigger, thereby masking any causal association between the variable and risk of headaches or migraines.

The present study confirms a female excess in the prevalence of headaches and migraines, without evidence of a gender difference in the presence or absence of an association between lifestyle variables and headaches. The present study also suggests a possible association between cigarette smoking, sleeping patterns, and headaches for both men and women, but not with alcohol consumption, exercise, or obesity.

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